Integrated Systems Research Program/Environmentally Responsible Aviation Project

As the Next Generation Air Transportation System (NextGen) evolves to meet the projected growth in demand for air transportation, the environmental impacts of noise and emissions are a growing concern and could limit the ability of the system to accommodate growth.

The Integrated Systems Research Program (ISRP), a $60M/year program effort started in FY2010, will conduct research at an integrated system-level on promising concepts and technologies and explore, assess, or demonstrate the benefits in a relevant environment. The integrated system-level research in this program will be coordinated with the on-going long-term, foundational research within the three other aeronautics research programs, and will be closely coordinated with other Federal Government agency efforts. The program will focus specifically on maturing and integrating technologies in major vehicle and operational systems and subsystems for accelerated transition to practical application.

The goal of the Environmentally Responsible Aviation (ERA) project, within ISRP, is to explore and document the feasibility, benefits, and technical risks of vehicle concepts and enabling technologies identified to have the potential to mitigate the impact of aviation on the environment. Through system-level analysis, promising vehicle and propulsion concepts and technologies will be down-selected based on their potential benefit towards simultaneously achieving fuel burn, noise and emissions metrics as shown in the table below.

These concepts and technologies will then be matured and their performance will be evaluated at the system and sub-system level in relevant environments. Among the concepts and technologies to be explored are the following:

- Advanced aircraft system architectures that enable simultaneous achievement of noise, Landing Take Off (LTO) NO_x and fuel burn goals in the N+2 timeframe (see table below)
- Drag reduction through laminar flow
- Advanced composite structural concepts for weight reduction
- Low NOx, fuel-flexible combustors
- Integration of advanced UHB engines for noise reduction and fuel burn improvements

	TECHNOLOGY GENERATIONS (Technology Readiness Level = 4-6)		
TECHNOLOGY BENEFITS*	N+1 (2015)	N+2 (2020**)	N+3 (2025)
Noise (cum below Stage 4)	- 32 dB	- 42 dB	- 71 dB
LTO NOx Emissions (below CAEP 6)	-60%	-75%	-80%
Cruise NOx Emissions (rel. to 2005 best in class)	-55%	-70%	-80%
Aircraft Fuel/Energy Consumption‡ (rel. to 2005 best in class)	-33%	-50%	-60%

* Projected benefits once technologies are matured and implemented by industry. Benefits vary by vehicle size and mission; N+1 and N+3 values are referenced to a 737-800 with CFM56-7B engines, N+2 values are referenced to a 777-200 with GE90 engines

** ERA's time phased approach includes advancing "long-pole" technologies to TRL 6 by 2015

‡ CO_2 emission benefits dependent on life-cycle CO_{2e} per MJ for fuel and/or energy source used

Table 1 – NASA Subsonic Transport System Level Metrics